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ABSTRACT

This teacher's guide is designed to help teachers conduct a course in fundamental blueprint reading as part of a workplace literacy program. The course offers nine central topics necessary for initial exposure to blueprint reading. Each topic lists several learning objectives, specific terms or vocabulary, and a measurable outcome. The topics in the course are as follows: basic views of objects, meaning of commonly used lines on a blueprint, basic dimensioning conventions, decimal tolerances, precision measuring, blueprint terms used in the title box and note column, symbols commonly used in company blueprints, metric and customary units, and angle measurement. The course uses company blueprints in the lessons. Components of the guide include an instructional guide for basic blueprint reading class, a pretest and a posttest, and 14 lesson plans and exercises. (KC)

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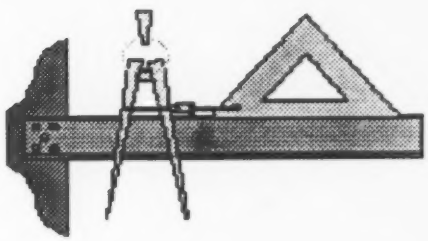
ED 402 467

INSTRUCTIONAL GUIDE FOR

BASIC BLUEPRINT READING



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A Project of the
NATIONAL WORKPLACE LITERACY PROGRAM
COLLEGE OF LAKE COUNTY
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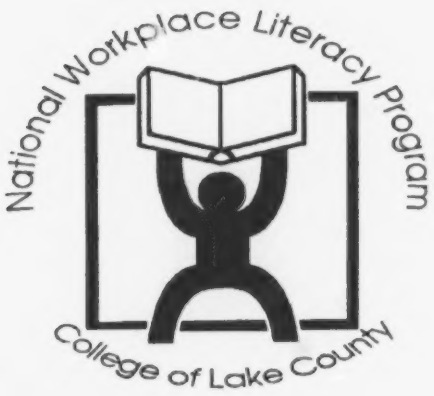
Basic Blueprint Reading

A basic blueprint reading class and curriculum was developed in response to a need from a National Workplace Literacy Program partner. All company employees interact or need to interact with company blueprints and be familiar with the basic symbols and principles. Blueprints are drawn using decimal measurement so a decimal review was incorporated into the curriculum.

The learning objectives and outcomes were developed based on the above identified needs. Actual company blueprints were used in the learner activities along with digital calipers, rulers, and protractors. A pre/post assessment was developed and administered to measure student progress.



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Project Director

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INTRODUCTION TO BASIC BLUEPRINT READING

This course is designed to emphasize the basic skills necessary to understand fundamental blueprint reading. The course offers nine central topics necessary for initial exposure to blueprint reading. Each topic lists several learning objectives, specific terms or vocabulary, and a measurable outcome. The order of the topics generally build upon each other, although completion of one topic does not necessarily depend on completion of the previous one. Selection of topics and level of difficulty depends on length of class and expressed and observed needs of the learners.

The topics included in this course are as follows:

- basic views of objects
- meaning of commonly used lines on a blueprint
- basic dimensioning conventions
- decimal tolerances
- precision measuring
- blueprint terms used in the title box and note column
- symbols commonly used in company blueprints
- metric and customary units
- angle measurement

Materials used in this course are as follows:

- company blueprints
- company products or parts that correspond to the blueprint
- digital calipers and other measuring tools used in the company
- calculator, if used

Components included in this course are as follows:

- Instructional Guide for Basic Blueprint Reading class
- pretest and posttest
- possible activities

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Instructional Guide for Basic Blueprint Reading

TOPIC	LEARNING OBJECTIVES	TERMS\VOCABULARY	OUTCOME
Basic views	a) Identify the basic views commonly displayed in a technical drawing.	Height Width Depth Plane	Draw a sketch of a simple object using two or three views on cross-sectioned or plain paper.
	b) Measure the height, width, depth of a simple object.		
	c) Name the three principle views necessary to describe the shape of an object.		
Meaning of lines	a) Describe the commonly used lines on a blueprint.	Object or visible line Hidden line Center line Dimension line Extension line Projection line	Identify the lines in a simple blueprint and match them with their meaning.
	b) Identify the meaning of commonly used lines in a blueprint.		
Basic Dimensioning Conventions	a) Name and describe the two ways a blueprint gives a complete description. *Views* and *Dimensions and Notes*	Extension line Dimension line Center line Leader	Identify the four basic lines used in dimensioning on a blueprint.
	b) Identify the difference between a dimension line and the visible lines of the drawing		

TOPIC	LEARNING OBJECTIVES	TERMS\VOCABULARY	OUTCOME
Decimal Tolerances	a) Define tolerance	Tolerance Upper limit Lower limit Sequence	Add and subtract decimal tolerance on a measurement in order to determine upper and lower limits.
	b) Add and subtract decimal tolerance attached to a measurement in order to determine upper and lower limits of size. (Example - 1.765 +/- .005)		
	c) Sequence decimal measurement.		
	d) Determine if a product measurement lies within tolerance		
Precision Measuring	a) Identify the common measurement tools used in the company.	Scale markings Graduations Calipers Rules Squares	State and record decimal measurement of a product using an appropriate measuring tool.
	b) Identify the graduation on the scale of each measurement tool.		
	c) Determine the size of the smallest division in one interval on a measurement tool.		
	d) Label scale marking on a measurement tool.		
	e) Read and record a specific dimension on a measuring tool. (If digital calipers are used, practice reading and recording the displayed measurement.)		

TOPIC	LEARNING OBJECTIVES	TERMS\VOCABULARY	OUTCOME
Blueprint Terms - Title Block	a) Locate the title block on a blueprint.	Title block Drawing title Drawing number Scale Tolerance Materials	Describe each piece of information contained within the title block of a blueprint.
	b) Describe each piece of information contained within the title block.		
Blueprint Symbols	a) Define GD&T (Geometric Dimensioning and Tolerancing) as a technical drawing language which specifies design requirements in terms of function.	GD&T Symbols commonly used in company blueprints Symbol characteristics Feature control frame	Identify symbols and their characteristic in various feature control frames.
	b) Identify commonly used symbols and their corresponding characteristics such as // means parallelism.		
	c) Locate the box (*feature control frame)* in which the symbols appear		
Metric Measurement	a) Define and explain metric length units.	Length Customary Units Metric Units Meter Millimeter Centimeter Decimeter	Given a product measurement in U. S. Standard, convert to metric measurement or vice versa.
	b) Demonstrate how metric units are related to corresponding customary units.		
	c) Explain how to convert from one unit to another.		
	d) Convert customary units to metric measure and vice versa.		
	e) Identify customary and metric measurements on a blueprint.		

TOPIC	LEARNING OBJECTIVES	TERMS\VOCABULARY	OUTCOME
Angle Measurement	a) Define angle as two lines starting at the same point and extending outward.	Angle Vertex Sides Degrees Protractor	Use a protractor to measure given angles. Use a protractor to draw given angles.
	b) Explain that angles are measured in degrees and that a protractor is a tool that measures angles.		
	c) Use a protractor to measure an angle.		
	d) Using a ruler and protractor, draw a given angle.		

PRE/POST ASSESSMENT

Name_____
Date_____Score_____

Directions: Use the attached blueprint to answer the following questions.

1.) What is the name of this product?_____

2.) What kind of lines are Ⓐ and Ⓑ ?_____

3.) What is the overall *depth* of the product?_____

4.) What is the overall *width* of the product?_____

5.) What is the size fo dimension Ⓐ?_____

6.) Name the three views that are used to describe the shape and size of the part.

_____, _____, and _____

7.) What encircled letter marks a hidden line?_____

8.) Define the word tolerance as it relates to blueprints.

9.) Determine which of the following product measurements lie within tolerance?
   a. dimension on the print: 3.264
   b. tolerance: ± .005
   c. actual measurements: circle any that are within tolerance

3.164	3.253
3.263	3.312
3.269	3.270

10.) Identify the characteristics of the following Geometric Dimensioning and Tolerancing (GDT) symbols:

// _____ ⌀ _____

⊥ _____ ∠ _____

11.) Sequence the following decimal measurements from smallest to largest.

4.54 .047 .740 .007 .054 5.075

12.) If an angle measures 40°, what is its complementary angle?_____

Lesson Plan #1
Blueprint Reading

Goal: Understand the basic views of objects.

Learning Objectives:

1.) Identify the basic views commonly displayed in a technical drawing.
2.) Measure the height, width, depth of a simple object.
3.) Understand the meaning of tenths and hundredths.

Instructional Activities:

1.) Administer the Pre/Post Assessment
2.)Show the class a simple blueprint and ask them what they know and don't know about the print. This discussion will guide what we specifically cover during the course.
3.) Sketch cardboard blocks in different configurations and from different angles. This will lead into a discussion on views (all six).
4.) Using one of the sketches, discuss the meaning of height, width and depth. Measure these on several different configurations of blocks.

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Lesson Plan #2
Blueprint Reading

Goal: Understand the basic views of objects on a blueprint.
Understand the meaning of lines on a blueprint.

Learning Objectives:

1.) Identify the basic views commonly displayed in a technical drawing.
2.) Measure the height, width, depth of a simple object.
3.) Describe the commonly used lines in a blueprint.
4.) Identify the meaning of commonly used lines in a blueprint.

Instructional Activities:

1.) *Do pages 1-3 in Discovering Basic Math Concepts: Decimal Addition and Subtraction.* These pages cover the meaning and comparing of tenths and the meaning of hundredths.
2.) Review the 6 possible views of an object and the 3 necessary ones.
3.) Sketch drawings of cardboard blocks in different configurations - introduce hidden lines.
4.) Compare an angle bracket (off the production floor) to the blueprint for the bracket, looking at the lines and views shown.

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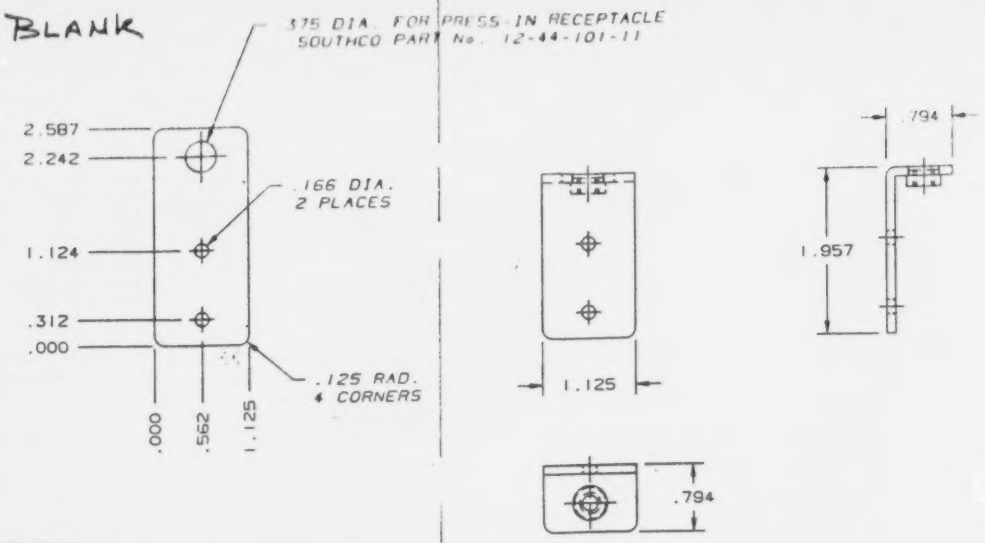

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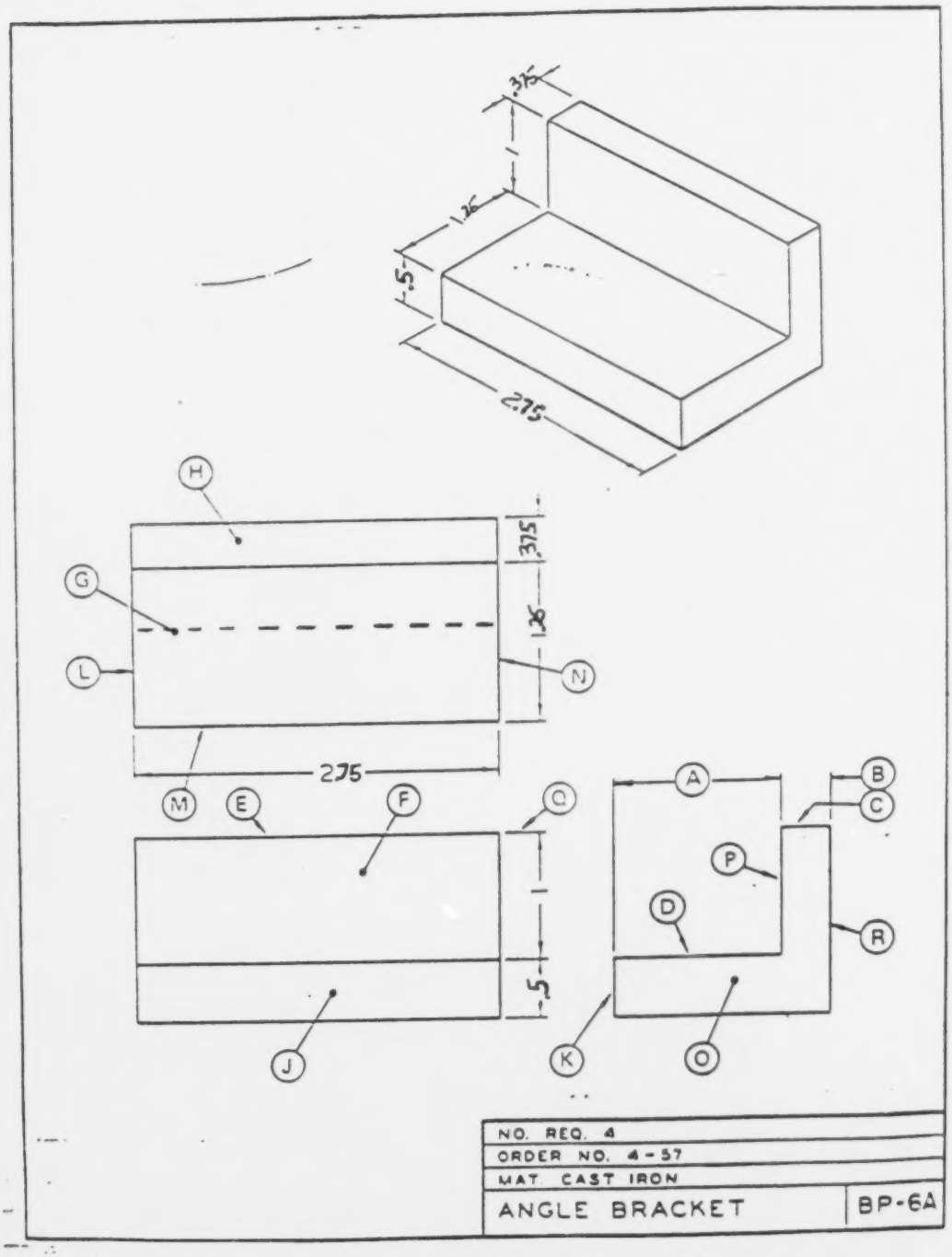

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Lesson Plan #3
Blueprint Reading

Goal: Understand the basic views of objects on a blueprint.
Understand the meaning of lines on a blueprint.

Learning Objectives:

1.) Identify the basic views commonly displayed in a technical drawing.
2.) Describe the commonly used lines in a blueprint.
3.) Identify the meaning of commonly used lines in a blueprint.
4.) Understand the meaning of hundredths and thousandths.

Instructional Activities:

1.) Complete pages 4-7 in *Discovering Basic Math Concepts: Decimal Addition and Subtraction.*
2.) Match the isometric drawing on worksheet 1 to the corresponding views on worksheet 2.
3.) Write in the letters from the isometric drawings on worksheet 3, that correspond to the various planes in the front, top, and side views shown on worksheet 4.

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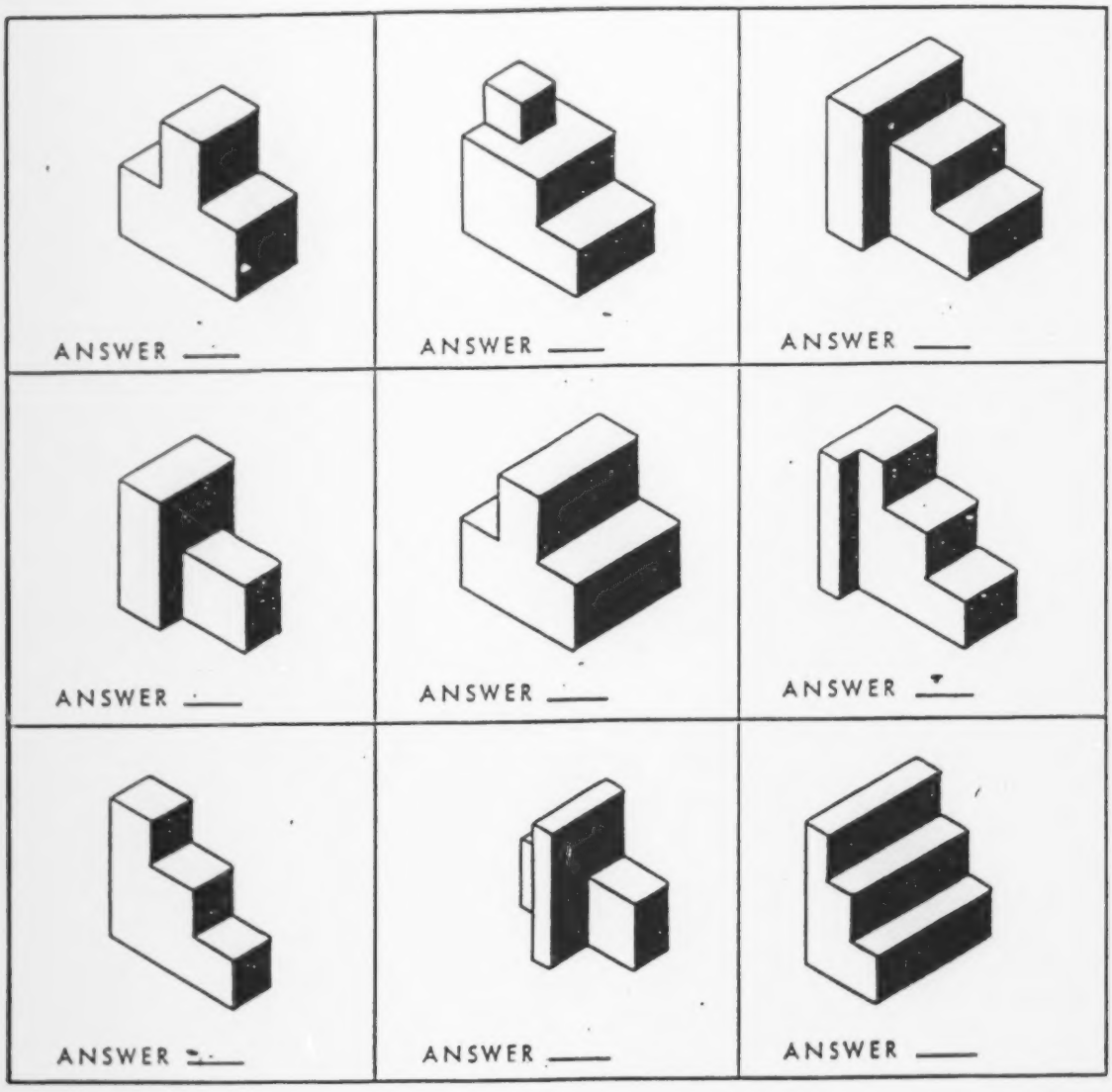
ANSWER ____
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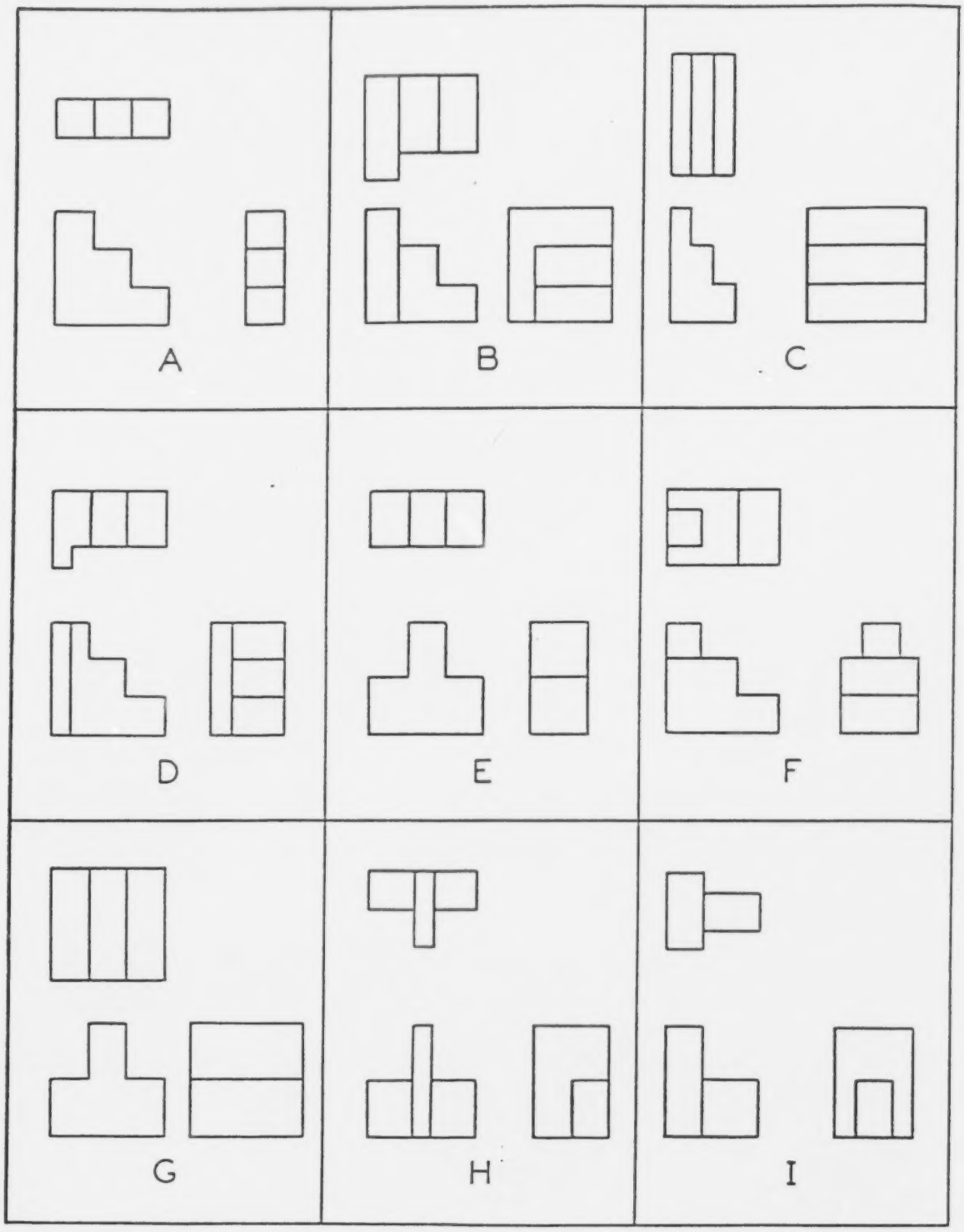
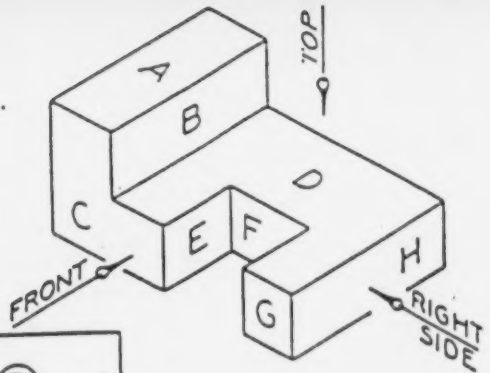
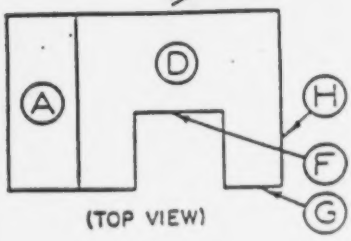
ANSWER ____


A
B
C
D
E
F
G
H
I

WORKSHEET #3

EXAMPLE





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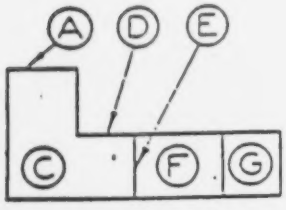

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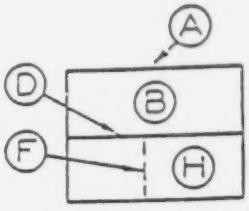
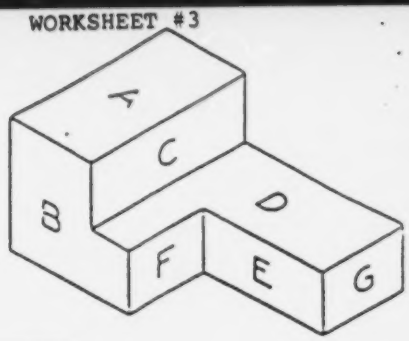
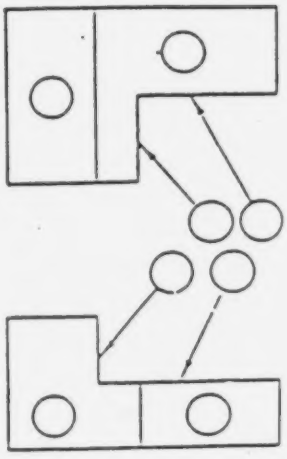
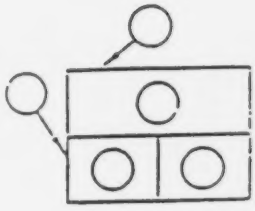


(RIGHT SIDE VIEW)







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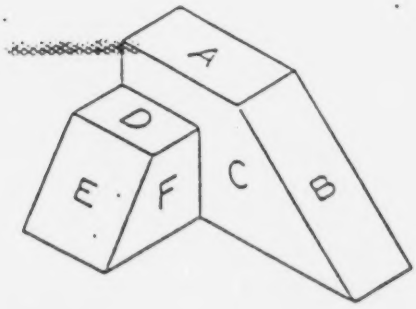

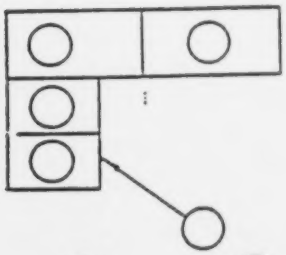

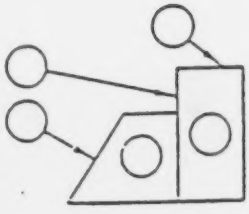

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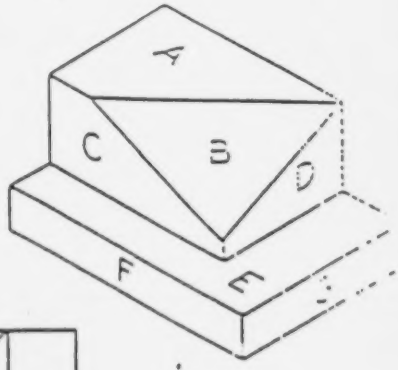

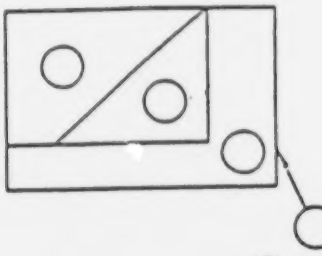

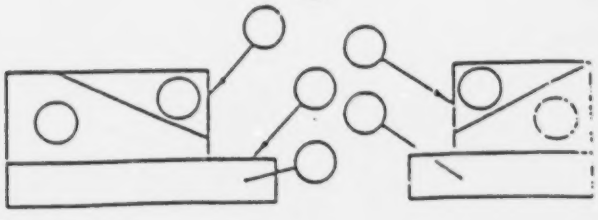

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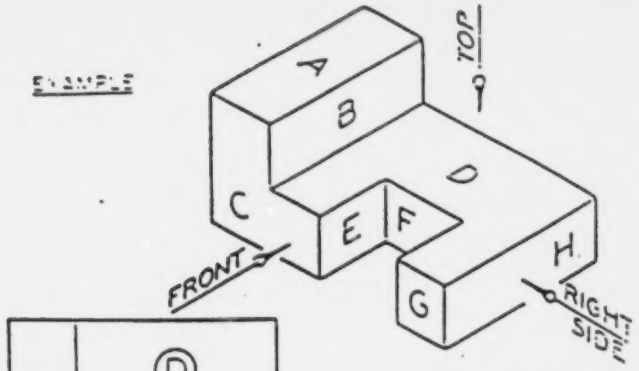
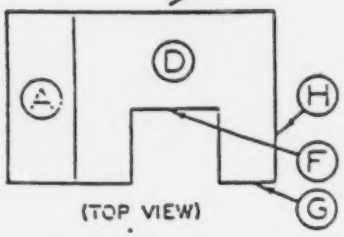
EXAMPLE





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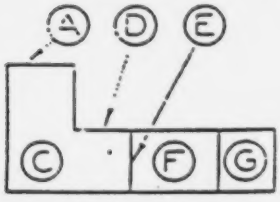

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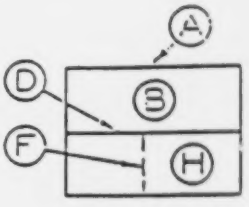

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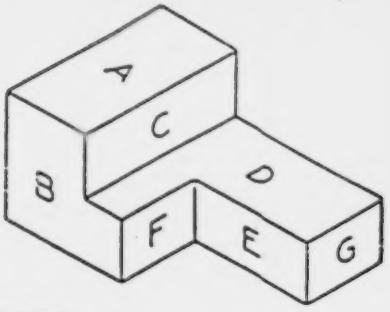

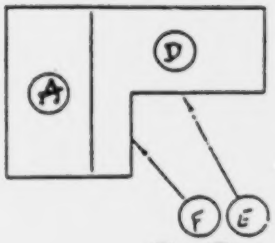

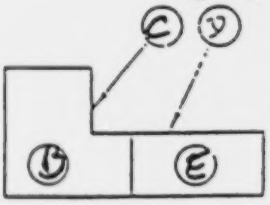

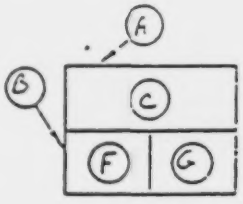

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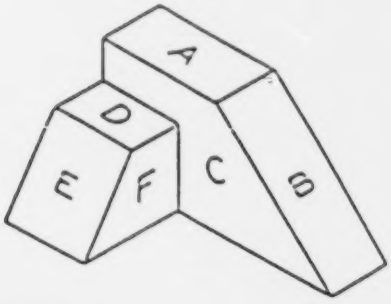

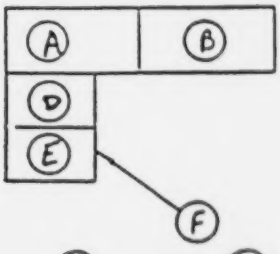

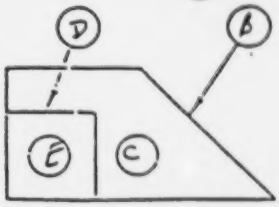

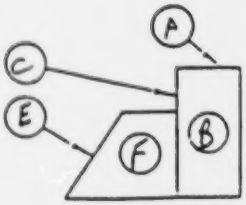

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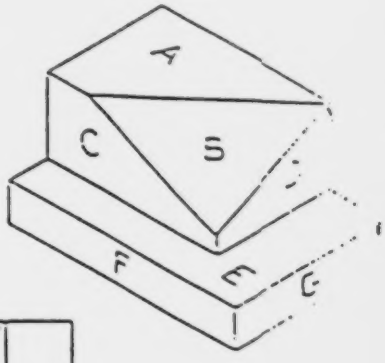

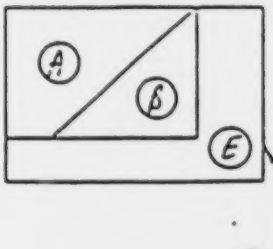

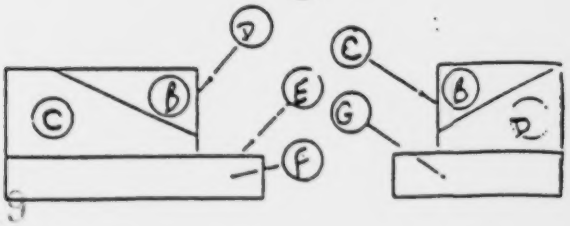

Lesson Plan #4
Blueprint Reading

Goal: Understand the basic views of objects on a blueprint.
Understand the meaning of lines on a blueprint.

Learning Objectives:

1.) Identify the basic views commonly displayed in a technical drawing.
2.) Describe the commonly used lines in a blueprint.
3.) Identify the meaning of commonly used lines in a blueprint.
4.) Understand the meaning of the place value of whole and decimal numbers.
5.) Understand how to read and say decimal numbers.

Instructional Activities:

1.) Complete pages 8-11 in *Discovering Basic Math Concepts: Decimal Addition and Subtraction.*
2.) Find the missing views on worksheet 5 and match them up with the corresponding views on worksheet 6.
3.) Discuss the various lines shown on the handout "A New Language" and using various company blueprints, look for the different kinds of lines on the prints.

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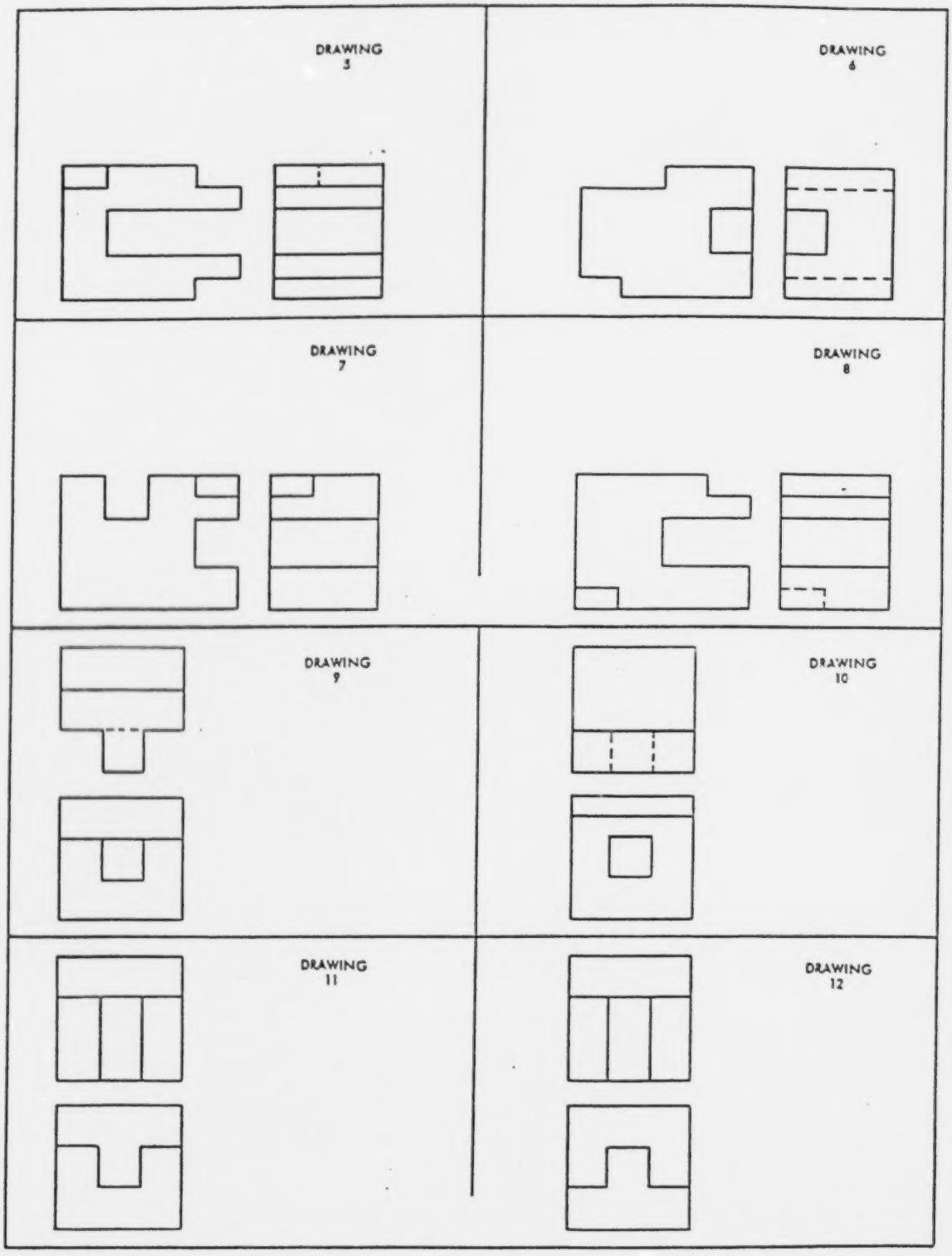
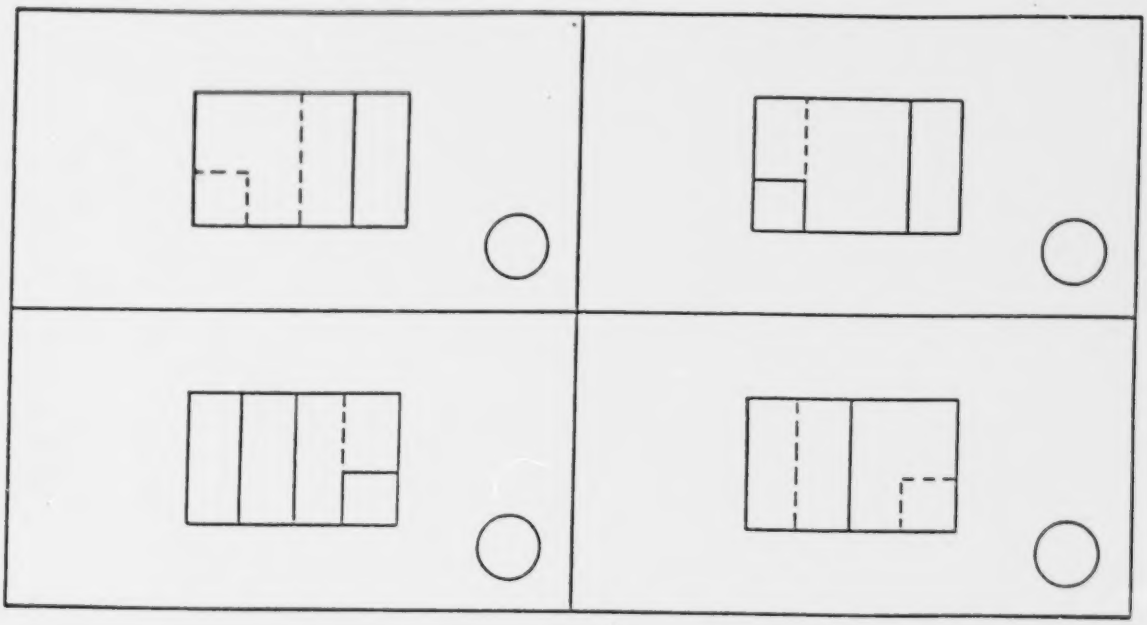
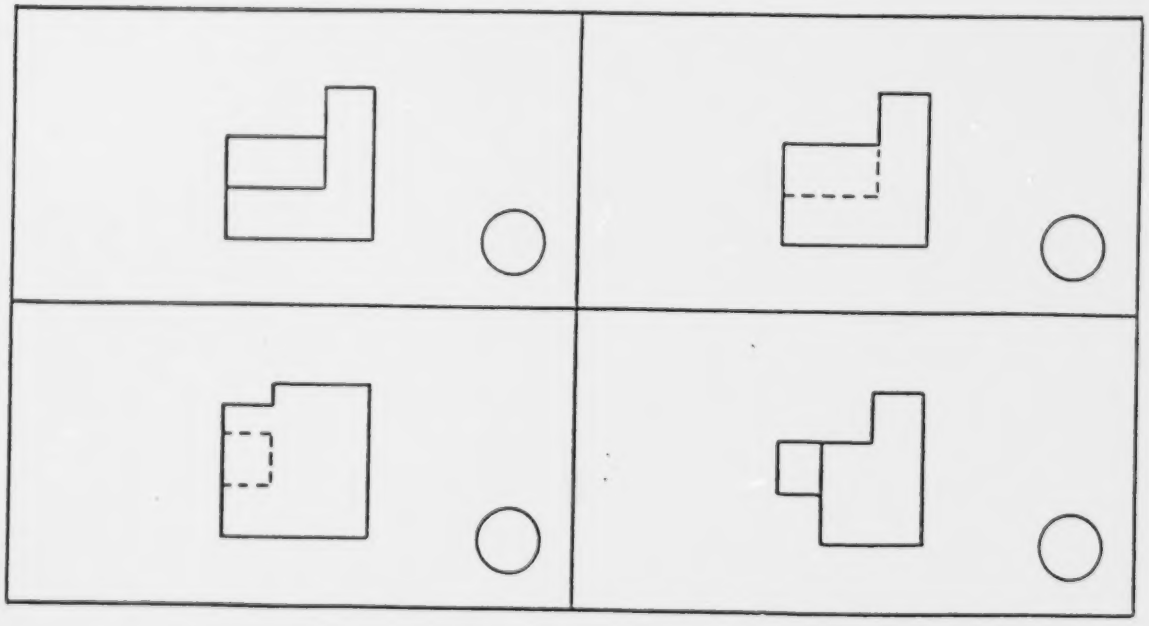

DRAWING 5
DRAWING 6
DRAWING 7
DRAWING 8
DRAWING 9
DRAWING 10
DRAWING 11
DRAWING 12





A NEW LANGUAGE

NAME AND USE	CONVENTIONAL REPRESENTATION	EXAMPLE
OBJECT LINE Define shape. Outline and detail objects.	THICK	OBJECT LINE
HIDDEN LINE Show hidden features.	$\frac{1}{8}$" (3 mm) THIN $\frac{1}{32}$" (0.75 mm)	HIDDEN LINE
CENTER LINE Locate centerpoints of arcs and circles.	$\frac{1}{16}$" (1.5 mm) THIN $\frac{1}{8}$" (3 mm) $\frac{3}{4}$" (18 mm) TO $1\frac{1}{2}$" (36 mm)	CENTER LINE CENTERPOINT
DIMENSION LINE Show size or location. **EXTENSION LINE** Define size or location.	DIMENSION LINE DIMENSION THIN 2'-6" EXTENSION LINE	DIMENSION LINE $1\frac{3}{4}$ EXTENSION LINE
LEADER Call out specific features.	OPEN ARROWHEAD THIN CLOSED ARROWHEAD X 3X	$1\frac{1}{2}$ DRILL LEADER
CUTTING PLANE Show internal features.	THICK $\frac{1}{8}$" (3 mm) $\frac{1}{16}$" (1.5 mm) A A $\frac{3}{4}$" (18 mm) TO $1\frac{1}{2}$" (36 mm)	A A LETTER IDENTIFIES SECTION VIEW CUTTING PLANE LINE
SECTION LINE Identify internal features.	$\frac{1}{16}$" (1.5 mm) THIN	SECTION LINES
BREAK LINE Show long breaks. **BREAK LINE** Show short breaks.	$\frac{3}{4}$" (18 mm) TO $1\frac{1}{2}$" (36 mm) THIN FREEHAND THICK	LONG BREAK LINE SHORT BREAK LINE

Figure 2-15. Lines on prints have specific meanings.

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Proctor, Thomas E., Holloway, Jay David, Jonathan F. 1995. Machine Trades Printreading. American Technical Publications, Inc.: Illinois

Lesson Plan #5
Blueprint Reading

Goal: Understand the meaning of lines on a blueprint.
Understand the basic dimensioning conventions used on a blueprint.

Learning Objectives:

1.) Learn how to convert inches to millimeters and millimeters to inches.
2.) Describe line terminology such as straight, parallel, perpendicular, vertical and horizontal. Find such lines on a blueprint.
3.) Describe terminology associated with holes such as diameter, radius and circumference. Find such features on a blueprint.
4.) Understand the meaning of the zeros in decimals.

Instructional Activities:

1.) Discuss the equations for converting in. to mm and mm to in. Then solve conversion problems.
2.) Complete pages 12 - 15 in *Discovering Basic Math Concepts: Decimal Addition and Subtraction.*
3.) Discuss line terminology and find such lines on a blueprint.
4.) Discuss hole terminology and find the symbol for diameter on a blueprint.

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Lesson Plan #6
Blueprint Reading

Goal: Understand the basic views of objects on a blueprint.
Understand the meaning of lines on a blueprint.
Understand the basic dimensioning conventions used on a blueprint.
Understand the meaning a symbols used on a blueprint.

Learning Objectives:

1.) Name the three principle views necessary to describe the shape of an object.
2.) Identify the meaning of commonly used lines on a blueprint.
3.) Identify the diameter symbol on a blueprint.
4.) Describe the use of a datum on a blueprint.

Instructional Activities:

1.) Review the equations for converting in. to mm and mm to in.
2.) Adminster the quiz over learning objectives 1-3 above.
3.) Discuss the use of a datum on blueprints. Look at a simple blueprint that uses a datum for dimensioning.

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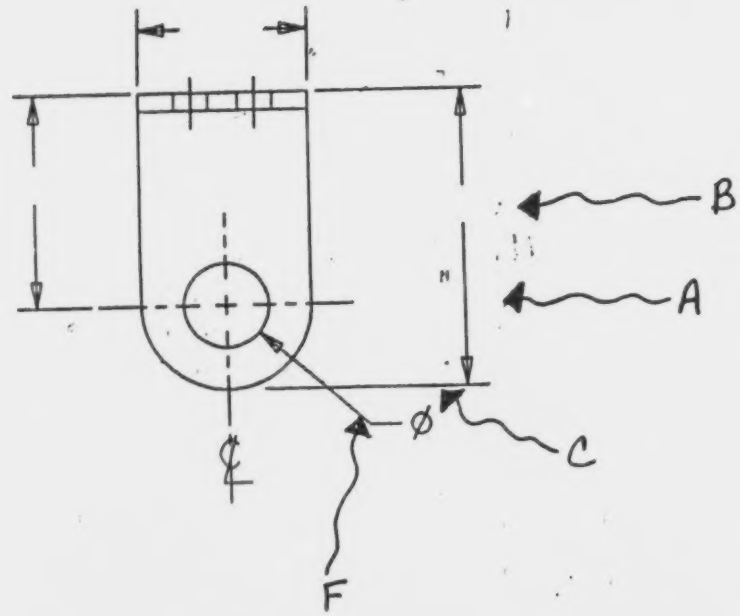
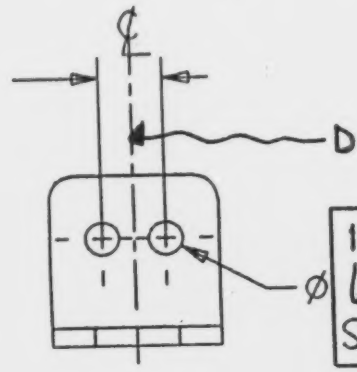
Match the following words to the lettered items on the print

1. ___ visible line
2. ___ extension line
3. ___ dimension line
4. ___ center line
5. ___ dimension
6. ___ leader

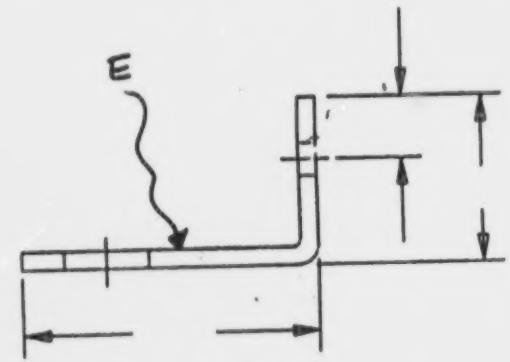


7. _____ View



8. _____ View

11. What does this (ø) symbol mean?



(10.) What is another name for visible line?

a.) solid line
b.) object line
c.) hidden line

9. _____ view

Lesson Plan #7
Blueprint Reading

Goal: Understand the meaning of lines on a blueprint.
Understand the basic dimensioning conventions used on a blueprint.
Understand the meaning a symbols used on a blueprint.

Learning Objectives:

1.) Identify angles between 0 and 90 degrees.
2.) Label scale markings on a protractor.
3.) Read and record specific angle dimensions on a protractor.
4.) Identify angles on a blueprint.
5.) Identify the meaning of terms associated with angles such as acute, obtuse and right.

Instructional Activities:

1.) Review the use of a datum on blueprints. Look at a simple blueprint that uses a datum for dimensioning.
2.) Discuss a full circle and the associated 0, 90, 180, 270, and 360 degrees of a circle.
3.) Complete pages 75-77 in *Math Matters For Adults: Measurement, Geometry, and Algebra.*
4.) Using a protractor, measure angles on various company products. Look at these angles on the corresponding blueprint.
5.) Complete pages 16-18 in *Discovering Basic Math Concepts: Decimal Addition and Subtraction.*

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Lesson Plan #8
Blueprint Reading

Goal: Understand the meaning of lines on a blueprint.
Understand the basic dimensioning conventions used on a blueprint.
Understand the meaning of symbols used on a blueprint.

Learning Objectives:

1.) Identify the meaning of the terms complementary and supplementary angles.
2.) Name and describe the two ways a blueprint gives a complete description. (*Views* and *Dimensions and Notes*)
3.) Identify the meaning of section, break and hidden lines on a blueprint.
4.) Identify commonly used GD & T (Geometric Dimensioning and Tolerancing) symbols and their corresponding characteristics, such as perpendicularity and squareness.

Instructional Activities:

1.) Review the degrees of angles of a circle.
2.) Complete pages 19-23 in *Discovering Basic Math Concepts: Decimal Addition and Subtraction.*
3.) Complete pages 78-79 in *Math Matters For Adults: Measurement, Geometry, and Algebra.*
4.) Look at a company print that includes the following items; section lines, break lines, hidden lines, and various geometric dimensioning symbols. Go out on the plant floor and look at the cabinet that corresponds with this print. Point out the views that the section lines, on the print, are showing.
5.) Discuss and show examples of various fasteners used at the company. Discuss how these are indicated on a blueprint (the notes must be read on the print - they give the specific fastener info.).

Lesson Plan #9
Blueprint Reading

Goal: Understand the meaning of lines on a blueprint.
Understand the basic dimensioning conventions used on a blueprint.
Understand the meaning of symbols used on a blueprint.

Learning Objectives:

1.) Understand how to use a protractor to measure angles.
2.) Understand how to work with complementary angles on a blueprint.
3.) Add and subtract decimal tolerance attached to a measurement in order to determine upper and lower limits of size.
4.) Identify the common measurement tools used in the company.

Instructional Activities:

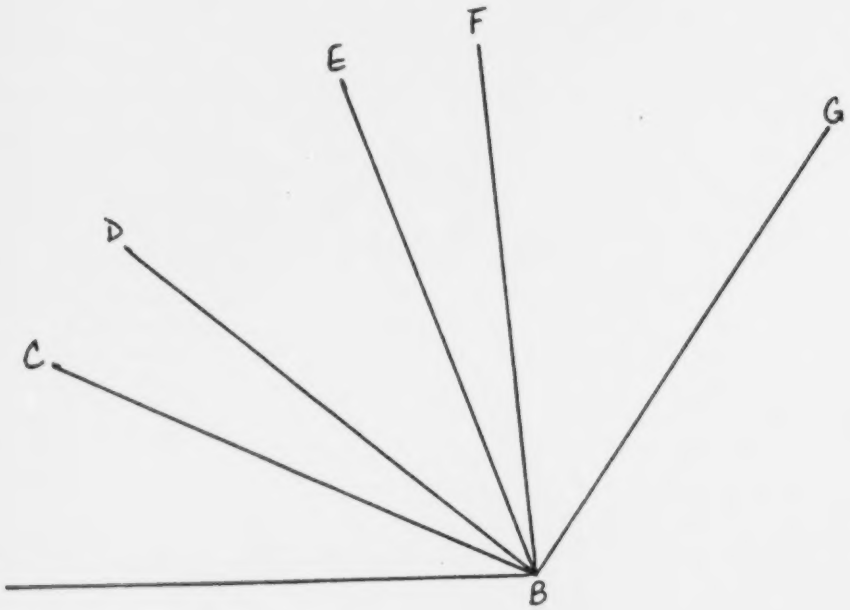
1.) Complete the worksheet on measuring angles.
2.) Look at company prints and corresponding parts that contain angles. Discuss measuring techniques that relate to complementary angles.
3.) Complete pages 24-27 in *Discovering Basic Math Concepts: Decimal Addition and Subtraction.*
4.) Using a hole caliper, learn how to measure hole mid-points on various company parts. Look at the corresponding prints for the measurements.

Directions:

Complete the measurements of the following angles.

Name _____

ACTIVITY 1



∠ ABC ____
∠ ABD ____
∠ ABE ____
∠ ABF ____
∠ ABG ____

∠ HIJ ____
∠ HIK ____
∠ HIL ____
∠ HIM ____

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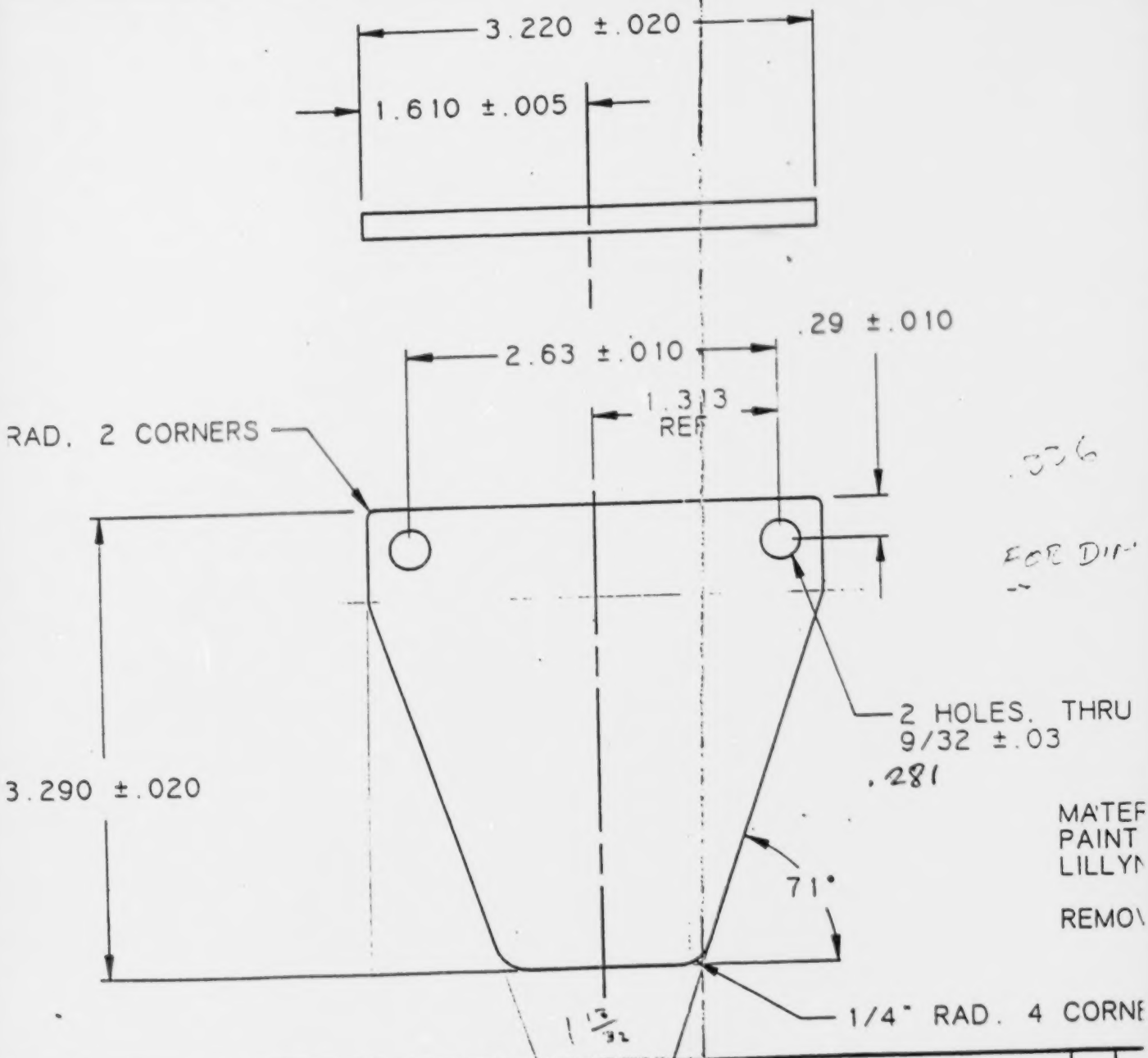
SAMPLE BLUEPRINT



MATEF
PAINT
LILLYN

REMOV

TOLERANCES, UNLESS OTHERWISE SPECIFIED

LAST DIGIT SHOWN	TOLERANCE
0.	±0.065
0.0	±0.030
0.00	±0.010
0.000	±0.003

ANGULAR ±1/2°

LTR	CHANGE	BY	AP
	NEW RELEASE		

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Lesson Plan #10
Blueprint Reading

Goal: Understand the meaning of lines on a blueprint.
Understand the basic dimensioning conventions used on a blueprint.
Understand the meaning of symbols used on a blueprint.
Understand how to use the precision measuring tools employed at GMP.

Learning Objectives:

1.) Name and describe the two ways a blueprint gives a complete description.
2.) Locate the title block on a blueprint.
3.) Describe each piece of information contained within the title block.
4.) Add and subtract decimal tolerance attached to a measurement in order to determine upper and lower limits of size.
5.) Identify the common measurement tools used in the company.
6.) Identify commonly used GD & T symbols and their corresponding characteristics.

Instructional Activities:

1.) Complete the worksheet on identifying information found in the title block and elsewhere on a Maxtec blueprint.
2.) Discuss *feature control frame.*
3.) Guest speaker from Quality Control will show the class the various measuring tools that are used at the company.

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Print Reading Activities

Using the attached print, answer the following questions.

1.) What company does this print come from?

2.) What is the name of the part?

3.) What revision (issue) is this print?

4.) Are the dimensions in inches or millimeters?

5.) What is the angle of the bend?

6.) What finish is to be used?

7.) What material must be used?

8.) What are the tolerances?

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9.) For the dimension .70, what are the upper and lower limits of the tolerance?

10.) For the dimension .543, what are the upper and lower limits of the tolerance?

11.) What is the scale of the drawing?

12.) What 3 items are necessary to interpret a print?

a.

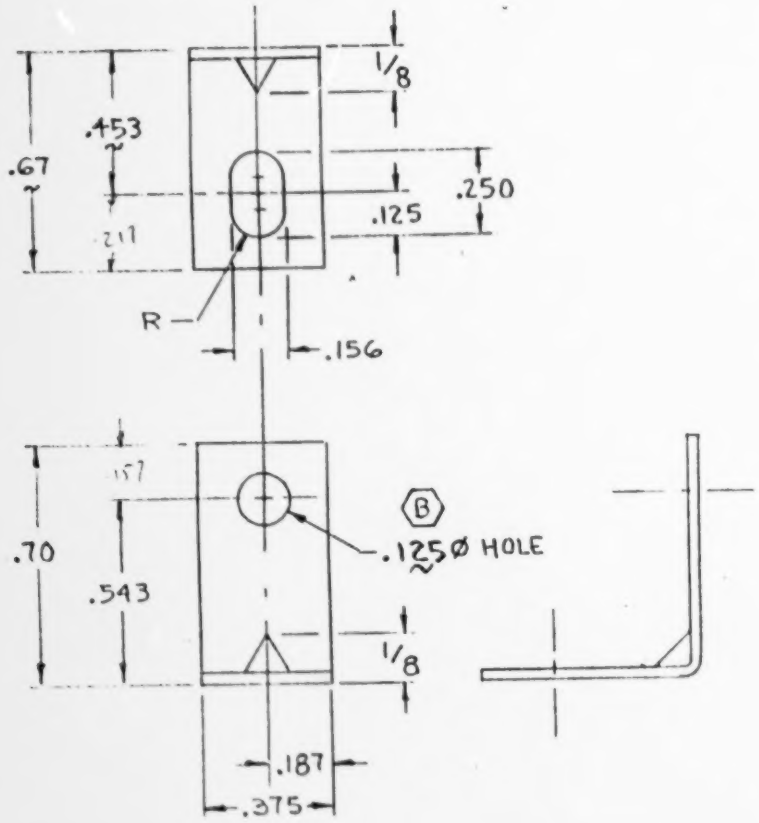
b.

c.

13.) Explain what this Geometric Dimensioning and Tolerancing symbol, //, means.

14.) What does this Geometric Dimensioning and Tolerancing symbol, O, mean?

ACTIVITY 1



NOTE:
1. MTL: .0478 (18 ga) CRS, COMMERCIAL QUALITY & TEMPER.
2. FINISH: ZINC PLATE

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SHEET 1 OF 1

251	642	9	001	ISSUE B

ISSUE	REVISIONS
A	REL. FOR QUOTATION JCM 2/11/91
B	.125Ø HOLE WAS .147 JCM 3/5/91
	REL'D FOR TOOLING RK 3/27/91
	REL'D FOR PURCHASE RK 3/27/91

MAX082-000

MAXTEC

TITLE
BRACKET, RIGHT ANGLE

UNLESS OTHERWISE SPECIFIED
1. ALL DIMENSIONS ARE IN INCHES
2. ALL BENDS ARE 90°
3. TOLERANCES:
FRACTIONS ± 1/64
DECIMAL (TWO PLACE) ± .010
DECIMAL (THREE PLACE) ± .005
HOLES ± .003
ANGLES ± 1°
DO NOT SCALE DRAWING.

DRAWN BY	DATE	SCALE
JCM	2/11/91	2/1
APPROVED HC/JP	APPROVED MAY	1ST MODEL PL5030

SHEET 1 OF 1

251	642	9	001	ISSUE B

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Lesson Plan #11
Blueprint Reading

Goal: Understand how to use the precision measuring tools employed at GMP.

Learning Objectives:

1.) Identify the common measurement tools used in the company.
2.) Identify the graduation on the scale of each measurement tool.
3.) Determine the size of the smallest division in one interval on a measurement tool.
4.) Read and record a specific dimension on a measuring tool.

Instructional Activities:

1.) Determine the size of the smallest division in one interval on the scales and calipers used at the company.
2.) Discuss the graduations on the various scales and calipers used at the company.
3.) Using scales and calipers, practice measuring and reading various objects.

Lesson Plan #12
Blueprint Reading

Goal: Understand the basic views in a blueprint.
Understand the meaning of lines used in a blueprint.
Understand the basic dimensioning conventions used in a blueprint.
Understand how to calculate decimal tolerances used on a blueprint.
Understand how to use precision measuring tools.
Understand symbols used on a blueprint.

Learning Objectives:

1.) Measure the height, width, and depth of a simple object.
2.) Label the three principle views necessary to describe the shape of an object.
3.) Label the commonly used lines on a blueprint.
4.) Add and subtract decimal tolerance attached to a measurement in order to determine upper and lower limits of size.
5.) Read and record a specific dimension on a measuring tool.
6.) Label the commonly used geometric dimensioning symbol for diameter on a blueprint in the correct location.

Instructional Activities:

1.) Complete the worksheet, "You want us to do what?". They will work in pairs to do this exercise.
2.) After everyone has finished, we will go around to each pair and have them show the structure that they made and the corresponding blueprint. The class members will have an opportunity to share any comments they may have about each project.

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"You want us to do what???"

Well, I want you to follow the set of instructions below and show me just how much you have gained from this blueprint reading class. Please read over the directions ***very carefully***, ask any questions that you may have, do what the directions tell you to do and HAVE FUN!!!

You will be working in pairs:

Step 1: Take the 3 pieces of wood that you have been given and nail them together into whatever shape you choose.

Step 2: Sketch the 3 views of your structure that are necessary in order to interpret the blueprint of this structure. **LABEL THE VIEWS ON THE PAPER**. (front,etc.) Make sure that the views are drawn in the correct position on the paper. Also, write "front" on whatever piece of wood that you see in the front view of your blueprint.

Step 3: Label at least **one example** of each of the following on your views.

* height (point this out with a leader line)
* width (use a leader to show this)
* depth (use a leader to show this)
* visible line
* hidden line
* dimension line
* dimension (measure the structure and give the true dimension of one part)
* extension line
* angle (measure the angle on the piece of wood that has one and indicate the degrees of the angle on your drawing)

Step 4: For the dimension that you have shown in step #3, assuming a tolerance of + .005, give the upper and lower limits of this dimension. Write them in the space below.

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Step 5: Pretend that there is a hole somewhere on your structure. Draw in the hole with a pen or pencil. Indicate the diameter of the hole (measure the drawn hole with the caliper) and use the Geometric Dimensioning and Tolerancing symbol to show this on the blueprint that you have drawn of your structure.

Step 6: Check your work by reading back over each direction after you have finished all of the steps. Check to make sure that you have completed every step correctly. Then put your structure and blueprint in the bag that has the same number on it as your pieces of wood. Be sure to write your names on the blueprint.

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Lesson Plan #13
Blueprint Reading

Goal: Understand the basic dimensioning conventions used in a blueprint.
Understand how to calculate decimal tolerances used on a blueprint.
Understand symbols used on a blueprint.
Understand the information found in a title block on a blueprint.

Learning Objectives:

1.) Define tolerance.
2.) Add and subtract decimal tolerance attached to a measurement to determine upper and lower limits of size.
3.) Sequence decimal measurements.
4.) Determine if a product measurement lies within tolerance.
5.) Locate the title block on a blueprint.
6.) Describe each piece of information found in a title block.
7.) Define GDT.
8.) Identify commonly used symbols and their corresponding characteristics such as // means parallelism.
9.) Locate the feature control frame where the GDT symbols are found.

Instructional Activities:

1.) Complete the Class Activities worksheet.
2.) Look at various blueprints to identify the different kinds of title blocks used by different companies and what the enclosed information means.
3.) Examine blueprints to find the feature control frames and the GDT symbols found within.
4.) Three students retook the first test in an effort to bring up their scores.

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Class Activities

1.) Identify the smallest interval on the scales that you are given.

2.) Define the word tolerance.

3.) Sequence the following decimal measurements from smallest to largest.

.026 .005 .260 .050 2.60 .015

4.) Determine which of the following product measurements lie within tolerance.

a. dimension on the print: 3.264
b. tolerance: + .005
c. actual measurements: circle any that are within the tolerance

3.164
3.253
3.263
3.312
3.269
3.270

5.) Define GDT.

6.) Identify the characteristics of the following GDT symbols:

//

⌀

⌭

⊥

∠

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Lesson #14
Blueprint Reading

We will be reviewing for the final test today at the beginning of class. Then the second half of class will be spent taking the test. I want to give it today so that if a student doesn't understand something, I can reteach it and they can have another chance to take the test again next Tuesday.

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Name _____

You're almost finished!!!!

You just need to show me a few more things that you have learned in this class. So, read each question very carefully, take your time working on each problem and check over your work before you hand me your paper when you are finished. Any questions??? Ask now!!!

1.) Sequence the following decimal measurements from smallest to largest.

4.54 .047 .740 .405 .007 .054 5.075

2.) Write out the names of the following decimal numbers.

.200 _____ tens / tenths

.20_____ hundreds / hundredths

.2_____ thousands / thousandths

3.) Identify the smallest interval on the scale below. Write the amount in decimal form to the thousandth.

_____

4.) Define the word tolerance.

5.) Determine the upper and lower limits of the tolerance from the following information.

a. dimension on the print: 23.668
b. tolerance: +/- .005

Upper limit_____

Lower limit_____

6.) Match the following symbols with their characteristics.

⊥	_____ cylindricity
⌀	_____ angularity
//	_____ perpendicularity
⌭	_____ diameter
∠	_____ parallelism

7.) If an angle measures 40°, what is its complementary angle?

8.) Using the title block below, list the following information:

a. company name

b. title of part

c. number of print

d. material

TOLERANCES (EXCEPT AS NOTED)			
DECIMAL ±	TITLE MOTO13-134 KEY HOLE BRACKET		SCALE F 1
FRACTIONAL ±	MATERIAL 14 GA. CRS(.075)	BY DATE 7/21/88	CHK'D. BEND A. .032
ANGULAR ±	TAPE No. K-362 TOOL No. LOC.		NUMBER A-3013-34

Linear Measurement

A. Steel Rule (English)

- read measurements and measure lengths on decimal-inch steel rules

Steel rules (or tapes) are widely used for applications which do not require a high degree of precision. The steel rule is often the most practical measuring instrument to use for checking dimensions where stock allowances for finishing are provided. Steel rules are also used for locating roughing cuts on machined pieces and for determining the approximate locations of parts for machine setups. Steel rules used in the machine shop are generally six inches long.

Reading Decimal-Inch Rules

An enlarged decimal-inch rule is shown. The top scale is graduated in hundredths of an inch (0.01"). The bottom scale is graduated in fiftieths of an inch (0.02"). On the top scale there are 100 divisions per inch.
On the bottom scale there are fifty divisions per inch. The longer lines represent tenths.

NOTE: Two hundredths = one fiftieth or $\frac{2}{100} = \frac{1}{50}$ or .02 = one fiftieth

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e.g. Read the following measurements on the enlarged decimal-inch rule shown above:

length A: 0.13"

length B: 0.70" = .7"

length C: $\frac{28}{50}$ = .56"

Often the edge of an object being measured does not fall exactly on a rule graduation. In these cases, read the measurement to the nearer rule graduation.

e.g. Read the following measurements, to the nearer graduation, on the enlarged decimal-inch rule shown:

A = 2"

B = 5"

C = 72"

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One more time with decimals!!!!

REVIEW

Write the numerals for the following numbers:

1.) forty-five hundredths _____

2.) six inches nine tenths _____

3.) thirteen inches two thousandths _____

4.) seven hundred thousandths _____

5.) thirty hundredths _____

6.) five hundred twenty-four _____

7.) eighty-six inches ten hundredths _____

8.) seventy -seven thousandths _____

9.) ninety-one hundredths _____

10.) one hundred inches one hundred thousandths _____

Write out the names of the following numbers:

1.) 56.087 _____

2.) .705 _____

3.) 4.900 _____

4.) .003 _____

5.) 8.820 _____

6.) 306.60 _____

Reduce the following numbers to the nearest thousandths:

1.) 5.9087 2.) .0774 3.) .3025 4.) .9528

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National Workplace Literacy Grant, 1994. *"Basic Strategies in Blueprint Reading" for United Technologies - Automotive*. Orangeburg-Calhoun Technical College: South Carolina

Suter, Alan D., 1990. *Number Sense: Discovering Basic Math Concepts*. Contemporary: Illinois

Mercer County Community College, Division of Corporate and Community Program, Trenton, NJ. Elaine S. Weinberg, Director,

Basic Strategies in Blueprint Reading for United Technologies-Automotive. Jacqueline Shuler, 1994 Vision, National Workplace Literacy Grant; Chris Walsh, Project Director, Orangeburg-Calhoun Technological College, 3250 St. Matthews Rd., Orangeburg, SC 29115